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Hearing difficulties and feelings of social isolation among Canadians aged 45 or older

by Pamela L. Ramage-Morin

Abstract

Background: Social isolation is associated with reduced health-related quality of life, increased morbidity, and mortality. Social isolation can be a concern for older Canadians, especially those with conditions that interfere with making and maintaining social connections.

Data and methods: The 2008/2009 Canadian Community Health Survey–Healthy Aging (CCHS-HA) collected data from a population-based sample of Canadians aged 45 or older living in private households. Frequencies, cross-tabulations and logistic regression were used to examine the prevalence of hearing difficulties and social isolation, and associations between them when controlling for sociodemographic characteristics, other functional limitations (for example, vision, mobility, and cognition), incontinence, and fear of falling.

Results: Social isolation was more common among 45- to 59-year-olds than among people aged 60 or older. Women were more likely than men to be socially isolated (16% versus 12%), but they were less likely to report hearing difficulties (5% versus 7%). Hearing difficulties were more prevalent at older ages: 25% of men and 18% of women at age 75 or older. When sociodemographic factors (age, education, living arrangements, regular driver, workforce participation), incontinence, fear of falling, and functional limitations were taken into account, the odds of being socially isolated increased with the severity of the hearing impairment among women but not among men (OR: 1.04, 95% CI: 1.00, 1.09)

Interpretation: Hearing difficulties are associated with age, and therefore, a growing public health concern as Canada's population ages. For women, hearing difficulties were found to be associated with social isolation.

Keywords: Aging, elderly, exclusion, hearing loss, loneliness, social alienation, social connectedness

The people who tend to thrive as they age are those who remain socially engaged.[1] They have a network of family and friends that allows them to participate in social life and achieve a sense of belonging and purpose.[2,3] Alternatively, people may be "socially isolated," lacking social contact, support, and a sense of belonging.[4-6] "Social isolation" does not pertain to those who have voluntarily disconnected; rather, socially isolated people have an unmet need for meaningful social interactions, which is often identified as loneliness.[4,7] Those who are socially isolated are more likely to experience a poor quality of life, morbidity, and mortality.[2,8-14] Social isolation among the elderly is a particular concern,[13,15] as it is estimated that more than 30% of Canadian seniors are at high risk.[7]

Hearing loss and associated communication difficulties can interfere with social activities and integration.[16] In 2012/2013, an estimated 4.5 million adults (19%) had some hearing loss in the range associated with normal speech; 8.4 million (35%) had high-frequency hearing loss, which is often related to aging.[17,18] At ages 70 to 79, 65% experienced loss in the speech frequency range, and almost everyone (94%) had some high-frequency hearing loss.[17] Because of a tendency to deny or minimize hearing loss and the insidious progress of the condition, only a fraction of people with loss actually reported hearing or communication difficulties—4% of adults, or fewer than a million.[16,17,19] As Canada's senior population increases from around 6 million in 2015 to a projected 9 million in 2030, the number of people with hearing difficulties is expected to rise.[20]

This study examines associations between hearing difficulties and social isolation. The presence of difficulties is based on self-reported ability to understand conversations, and therefore, reflects a functional limitation rather than a biological loss in hearing acuity. Hearing difficulties are further classified as corrected (able to hear with a hearing aid) or not (cannot hear in some situations, even with a hearing aid).[21]

Social isolation has been conceptualized and measured[9] in a number of ways.[6,7,9,22,23] For the present analysis, rather than objective measures such as network size or frequency of participation, the focus is on perceived or subjective social isolation, measured as a combination of loneliness and a weak sense of community belonging. Perceived social isolation reflects how people feel about their relationships and participation, and whether their desired circumstances differ from their actual situation.[4,22,24]

Associations between hearing impairment and social isolation or loneliness have been explored in a variety of populations, although not in Canada, and often with smaller sample sizes.[5,16,25-27] This study presents information on the issue among Canadians aged 45 or older, based on a large sample representative of the household population across the 10 provinces.

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Methods

Data source

The data are from the 2008/2009 Canadian Community Health Survey–Health Aging (CCHS–HA), a cross-sectional survey that targeted people aged 45 or older living in private dwellings in the 10 provinces. The survey excluded residents of the three territories, First Nations reserves, certain remote regions, and institutions, and full-time members of the Canadian Forces. Data were collected from December 1, 2008 through November 30, 2009, primarily using computer-assisted personal interviews. The combined household- and person-level response rate was 74.4%. Proxy respondents numbered 689 and comprised 2.2% of the sample (Appendix Table A). Because social isolation was determined from subjective questions that were not administered to these respondents, they were excluded, leaving a study sample of 30,176. Details about the CCHS–HA are available on the Statistics Canada website (www.statcan.gc.ca).

Measures

Levels of functional impairment for *hearing, vision, speech, mobility, dexterity, pain, emotion,* and *cognition* were based on the Health Utilities Index-Mark 3 (HUI3).[28,29] Each HUI3 attribute has five or six levels with corresponding utility-based scores ranging from 0.00 (most impaired) to 1.00 (no impairment). Continuous variables for each attribute were created using their respective utility scores for the logistic regression models. Prevalence estimates for *hearing difficulties* were based on an ordinal variable that distinguished between no (level 1), mild (level 2) and moderate/severe (levels 3 to 6) impairment.[30] The other types of functional impairment were dichotomized as no/mild (levels 1, 2) versus moderate/severe (levels greater than 2), except for cognition where levels 1 to 3 corresponded to no/mild impairment, and levels greater than 3, to moderate/severe impairment.[30]

Replicating the approach of Corna et al.,[21] hearing ability was classified as no difficulty, corrected, not corrected, or cannot hear at all, using the response patterns (1 = yes, 2 = no, 6 = not applicable) to the HUI3 hearing questions: Are you usually able to hear what is said in a group conversation with at least three other people without a hearing aid? (Q1); with a hearing aid? (Q2); Are you able to hear at all? (Q3); Are you usually able to hear what is said in a conversation with one other person in a quiet room without a hearing aid? (Q4); with a hearing aid? (Q5) (Text table 1).

Incontinence was established by asking: "Do you suffer from urinary incontinence?" Respondents were instructed to respond "yes" if the condition had been diagnosed by a health professional and had lasted, or was expected to last, at least six months.

Fear of falling was based on a positive response to the question, "Are you worried or concerned that in the future you might fall?", and was asked of respondents aged 65 or older. A negative response was assumed for younger respondents.

Daily *stress* was classified as high (most days quite a bit or extremely stressful) or low (most days not at all, not very or a bit stressful).

In addition to *age* and *sex*, the socio-demographic variables in the analysis were *household education*—highest level obtained by any household member (less than postsecondary, postsecondary graduation or more); *marital status*; *living arrangements* (alone or with others; "others" could be spouse, children, friend, or other); and *regular driver* defined as having a valid driver's licence and driving at least once in the past month. *Labour force participation* was based on the previous week: worked at job/absent from job/not working but looking for job. Questions were limited to respondents younger than 75; people aged 75 or older were classified as non-labour force participants.

Social isolation was derived from two variables that measured loneliness and community belonging. From the Three-Item Loneliness Scale, which was based on the Revised UCLA Loneliness Scale,[31] respondents were asked: "How often do you feel: that you lack companionship? left out? isolated from others?" Response category values (1 = hardly ever; 2 = some of the time; 3 = often) were summed. Respondents who scored 3 were categorized as not lonely versus scores 4 to 9.

Sense of community belonging was determined with one question: "How would you describe your sense of belonging to your local community? Would you say it is very strong? somewhat strong? somewhat weak? very weak?" Respondents were categorized as

Text table 1
Classification of hearing ability according to response patterns to Health Utilities Index-Mark 3 (HUI3) hearing questions

Category	Response patterns (1 = yes, 2 = no, 6 = not applicable) to HUI3 questions (Q1 to Q5)	Description
No hearing difficulty	16666	Answered "yes" to question 1
Corrected	21616, 21621	Reported all hearing problems as corrected (able to hear with hearing aid)
Not corrected	21622, 22116, 22121, 22122	Reported any identified hearing problem as uncorrected (not able to hear in some situations, even with hearing aid)
Cannot hear at all	22266	Answered "no" to question 3

Text table 2
Typology of social connectedness

Sense of community belonging	Lonely	
	Yes	No
Weak/Somewhat weak	Socially isolated	Solitary
Strong/Somewhat strong	Lonely	Connected

being socially isolated if they were lonely and had a somewhat weak or weak sense of community belonging (Text table 2).

The tetrachoric correlation between loneliness and sense of community belonging was 0.2, supporting the notion that one can simultaneously feel lonely but connected to the community, and vice versa. Additional mutually exclusive groups (*lonely*, *solitary*, and *connected*) were derived from the two variables.

Analytical techniques

Men and women were analyzed separately. Weighted cross-tabulations and logistic regression models were used to examine associations between independent variables and social isolation. A preliminary logistic model determined if an association existed between hearing difficulty and social isolation that was conditional on respondents' age. The interaction term was not significant (data not shown); subsequent models pooled respondents and controlled for age. Multiple logistic regression models controlled for age (continuous) and age^2 because of the non-linear relationship between social isolation and age (Figure 1), in addition to potential confounders known to be associated with social isolation. A minimum change of 0.05 on the HUI3 single-attribute utility scores was considered meaningful.[32,33] Marital status and stress were excluded from the logistic regression because of their respective correlations with living arrangements and emotional impairment. Data were weighted on age group, sex and province and adjusted for non-response. To account for survey design effects of the CCHS-HA, coefficients of variation and p-values were estimated, and significance tests were performed using the bootstrap technique.[34,35]

Results

Characteristics of study population

The study sample of 30,176 respondents was weighted to represent 13.3 million people aged 45 or older, with a mean age of 60.4 (Appendix Table A). Almost half (48%) were men, and most (69%) lived in households where at least one person was a postsecondary graduate.

Hearing difficulty

In 2008/2009, an estimated 864,000 people (7%) aged 45 or older reported some hearing difficulty; for half of these people, the difficulty was mild rather than moderate or severe (Table 1). Around 5% had corrected hearing, and 2% could not hear what was said in some circumstances, even with a hearing aid. Hearing impairment was more common at older ages—21% among those aged 75 or older. Men were generally more likely than women to have a hearing impairment—8% versus 5%—although significant differences between the sexes were evident only in the older age groups.

Perceived social isolation

An estimated 1.9 million people—12% of men and 16% of women—experienced social isolation, in that they reported feelings of loneliness and a weak or somewhat weak sense of community belonging (Table 2).

Social isolation was more common at ages 45 to 59 than among most older age groups (Table 2), although the continuous data suggest that social isolation may rise again at older ages (Figure 1).

Overall, labour force participation was not associated with social isolation, although 45- to 59-year-olds who were not in the labour force were significantly more likely than individuals of the same age who were working or actively looking for work to feel isolated.

High levels of daily stress were associated with social isolation, and 28% (95% CI, 26 to 29) of 45- to 59-year-olds reported that most days were quite a bit or extremely stressful, significantly more than estimates for people aged 60 to 74

Table 1
Level of hearing difficulty, hearing status and prevalence of any hearing difficulty by age group, by sex, household population aged 45 or older, Canada excluding territories, 2008/2009

	Both sexes				Men				Women			
	Number '000	%	95% confidence interval from	to	Number '000	%	95% confidence interval from	to	Number '000	%	95% confidence interval from	to
Level of hearing difficulty												
None	12,347	93.5	93.0	93.9	5,804	92.1	91.4	92.8	6,543	94.7†	94.2	95.1
Any hearing difficulty	864	6.5	6.1	7.0	497	7.9	7.2	8.6	367	5.3†	4.9	5.8
Mild	431	3.3	3.0	3.6	256	4.1	3.6	4.5	175	2.5†	2.2	2.9
Moderate or severe	433	3.3	3.0	3.6	241	3.8	3.4	4.3	192	2.8†	2.5	3.1
Hearing status (any hearing difficulty)												
Corrected	592	4.5	4.2	4.8	339	5.4	4.9	5.9	254	3.7†	3.3	4.1
Uncorrected	265	2.0	1.8	2.3	156	2.5	2.1	3.0	109	1.6†	1.3	1.9
Age group (any hearing difficulty)												
45 to 59	192	2.7	2.2	3.2	112	3.2	2.4	4.2	80	2.2	1.6	2.9
60 to 74	291	6.9†	6.3	7.6	196	9.8†	8.7	10.9	95	4.3†‡	3.7	5.1
75 or older	382	20.8†	19.4	22.2	189	24.6†	22.3	27.0	193	18.0†‡	16.5	19.6

† significantly different from preceding age group ($p < 0.01$)
‡ significantly different from men ($p < 0.05$)
Source: 2008/2009 Canadian Community Health Survey–Healthy Aging.

Table 2
Number and percentage reporting social isolation, by selected characteristics and sex, household population aged 45 or older, Canada excluding territories, 2008/2009

	Men				Women			
			95% confidence interval				95% confidence interval	
Characteristic	Number '000	%	from	to	Number '000	%	from	to
Total	775	12.3	11.3	13.4	1,106	16.0‡	15.0	17.2
Age group								
45 to 59	495	14.1*†	12.3	16.0	636	17.4*†‡	15.7	19.3
60 to 74†	202	10.1	8.9	11.3	303	13.9‡	12.7	15.2
75 or older	78	10.1	8.7	11.7	167	15.6‡	14.1	17.3
Labour force participation								
45 to 74								
Yes	477	12.1	10.6	13.8	537	15.6‡	13.9	17.3
No†	298	12.6	11.3	14.0	568	16.5‡	15.2	17.9
45 to 59								
Yes	399	12.9*	11.1	14.9	464	16.2*‡	14.3	18.3
No†	95	23.1	18.2	29.0	171	21.9	18.1	26.3
60 to 74								
Yes	77	9.4	7.6	11.5	73	12.4‡	10.3	14.8
No†	125	10.6	9.1	12.2	230	14.5‡	13.0	16.1
Household education								
Postsecondary or higher†	501	11.4	10.1	12.7	707	16.0‡	14.5	17.5
Less than postsecondary	255	14.8*	13.0	16.7	377	16.3	14.8	17.9
Marital status								
Single, never married	108	26.0*	21.3	31.3	95	22.4*	18.6	26.6
Married/Common-law†	459	9.1	8.0	10.3	623	13.4‡	12.0	14.9
Widowed, separated, divorced	207	25.5*†	22.3	29.0	388	21.5*†‡	19.9	23.1
Living arrangements								
Alone	259	26.2*	23.5	29.1	326	21.1*†‡	19.6	22.7
With others†	511	9.7	8.6	10.9	773	14.6‡	13.3	15.9
Regular driver								
Yes	678	11.7*	10.6	12.9	779	14.8*†‡	13.7	16.1
No†	97	19.2	16.2	22.6	326	20.0	18.1	22.0
Hearing difficulty								
None†	689	12.0	10.8	13.2	1,011	15.6‡	14.5	16.8
Any hearing difficulty	72	14.7	12.1	17.8	82	23.2*†‡	19.1	27.7
Mild	40	15.8	12.2	20.2	38	22.6*	17.4	28.8
Moderate or severe	32	13.6	10.3	17.8	44	23.7*†‡	18.1	30.3
Hearing status								
Corrected	54	16.1	12.7	20.1	51	20.9	16.9	25.4
Uncorrected†	18	11.7‡	8.3	16.1	31	29.1†‡	20.9	39.0
Moderate/Severe functional impairment								
Vision								
Yes	17‡	18.3‡	11.9	27.0	36	26.5*	20.5	33.5
No†	754	12.2	11.1	13.3	1,066	15.9‡	14.8	17.0
Speech								
Yes	F	F	...	...	F	F	...	...
No†	774	12.3	11.2	13.4	1,104	16.0‡	15.0	17.1
Mobility								
Yes	37	16.7*	13.2	21.0	110	25.7*†‡	22.5	29.2
No†	738	12.1	11.1	13.3	995	15.4‡	14.3	16.6
Dexterity								
Yes	F	F	...	...	8‡	27.2‡	16.4	41.6
No†	774	12.3	11.3	13.5	1,098	16.0‡	15.0	17.1
Pain								
Yes	157	17.0*	14.3	20.2	331	23.7*†‡	21.1	26.5
No†	618	11.5	10.4	12.7	773	14.1†‡	12.9	15.3

(14%; 95% CI, 13 to 15) or 75 or older (10%; 95% CI, 9 to 11) (data not shown).

Women were consistently more likely than men to be socially isolated (except for women who were widowed, separated or divorced, or living alone). Social isolation was associated with lower education (men), living alone, not having a spouse, incontinence (women), fear of falling, high daily stress, and some functional impairments—vision (women), mobility, pain, emotion, and cognition. The latter two are noteworthy; men and women with these difficulties were two to four times more likely to be socially isolated than were people without these impairments. Regular drivers were less likely than non-drivers to be socially isolated.

Hearing difficulties and perceived social isolation

Among men, hearing difficulties were not associated with social isolation (Table 2), even when sociodemographic characteristics and other conditions were taken into account (Table 3). By contrast, 23% of women with hearing difficulties reported feeling socially isolated, compared with 16% of women without hearing difficulties. This association remained when controlling for other factors—as hearing difficulties increased, so did the odds of being socially isolated (1.04).

Although point estimates for women suggest a gradient in the prevalence of social isolation from those with no hearing impairment to corrected and then uncorrected hearing difficulties, the difference between the latter groups was not significant (Table 2, Figure 2). Men with corrected hearing difficulties were more likely than those with no impairment to be socially isolated.

Discussion

According to the present study, hearing difficulties were associated with social isolation for women but not men. These findings persisted when sociodemographic factors, other functional

limitations, incontinence and fear of falling were taken into account. Associations between hearing difficulties and social isolation have been observed in other research, although the results were not stratified by sex.[5,25,36,37] For example, after reporting that the prevalence of social isolation did not differ between men and women aged 60 or older, Hawthorne et al.[5] analyzed both sexes together. By contrast, in this study, when both sexes were considered together, a significant relationship between hearing difficulties and social isolation was evident. The stratified analysis revealed that this was driven by the association among women. In every age group, women were significantly more likely than men to be socially isolated.

Hearing difficulties can lead to social isolation if people withdraw to avoid the challenge of following conversations or embarrassment over their hearing loss or use of a hearing aid.[37,38] Hearing loss has also been associated with poor mobility and falls, lower health status and cognitive decline, all of which can contribute to social isolation.[39-42] Although such associations were evident in the current analysis, hearing difficulties were independently associated with social isolation for women.

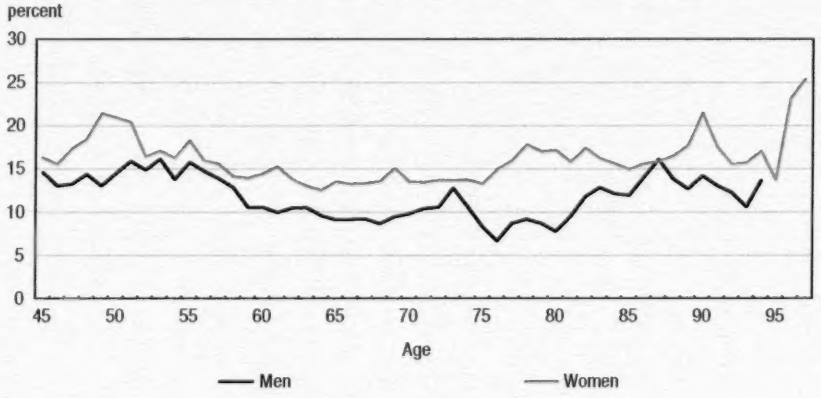
Despite substantial advances in assistive technology,[43] most Canadian adults (88%) with hearing loss do not use hearing aids.[17] The reasons include the cost of the devices and the belief that they are not needed.[38] This study compared social isolation among those whose hearing aids enabled them to understand what was said in conversations (corrected hearing) and those who could not hear in some situations despite hearing aid use (uncorrected). Although estimates of social isolation among those with corrected and uncorrected hearing did not differ significantly, the point estimates for women revealed the expected gradient. The opposite was true for men; those with corrected hearing appeared more likely than those with uncorrected hearing difficulties to be socially isolated. Schneider et al.[44] reported that hearing loss was associated with greater dependency on family and community members. It is possible that men with uncorrected hearing difficulties are more dependent, which results in social interactions that help protect against isolation. Dawes et al.[36] also found a positive association between hearing aid use and social isolation.

Table 2 (end)
Number and percentage reporting social isolation, by selected characteristics and sex, household population aged 45 or older, Canada excluding territories, 2008/2009

	Men				Women			
			95% confidence interval				95% confidence interval	
Characteristic	Number '000	%	from	to	Number '000	%	from	to
Moderate/Severe functional impairment								
Emotion								
Yes	100	43.0*	36.3	49.9	137	52.0*	45.8	58.1
No†	672	11.1	10.1	12.2	967	14.6‡	13.6	15.7
Cognition								
Yes	103	27.9*	22.1	34.5	151	34.5*	28.7	40.8
No†	672	11.3	10.3	12.5	954	14.8‡	13.8	15.8
Incontinence								
Yes	35	14.2	11.2	17.9	117	22.3*‡	19.3	25.5
No†	739	12.2	11.1	13.4	989	15.5‡	14.5	16.7
Fear of falling								
Yes	67	15.3*	12.9	18.0	184	19.5*‡	17.4	21.8
No†	707	12.1	11.0	13.3	921	15.5‡	14.4	16.7
Daily stress								
High (quite a bit /extremely stressful)	204	16.7*	14.2	19.5	343	22.8*‡	19.9	26.0
Low† (not at all/not very/a bit stressful)	570	11.2	10.1	12.5	762	14.2‡	13.1	15.3

... not applicable
‡ use with caution
F too unreliable to be published
* significantly different from estimate for reference category ($p < 0.05$)
† reference category
‡ significantly different from estimate for men ($p < 0.05$)
Source: 2008/2009 Canadian Community Health Survey–Healthy Aging.

Figure 1
Percentage reporting social isolation (3-year moving average), by age and sex, household population aged 45 or older, Canada excluding territories, 2008/2009



Source: 2008/2009 Canadian Community Health Survey–Healthy Aging.

This study established the level of hearing difficulties using the HUI3, which assesses self-reported ability to understand conversations in different circumstances. In other studies that relied on self-reported hearing status, the measures and situations differed—for example, if respondents can hear well when the speech is loud or whispered, over the telephone, or in a noisy room.[5,25] Alternatively, some studies measured biological hearing loss using audiometric or other testing.[16,36] Monzani et al.[45] distinguished between the two when they described self-reported hearing difficulty as the subjective experience of disability that arises from actual hearing loss. Self-reported hearing difficulty underestimates actual hearing loss.[16,17] The people who self-report may be those with the most severe loss or participate in activities that depend heavily on hearing acuity (for example, musicians, birdwatchers).[25] Despite the differences, hearing loss established using audiometric testing and self-reported hearing difficulties have both been associated with poor social outcomes[16] and mortality.[11,39]

Social isolation has been defined and measured in a number of ways.[4,6,13,22,23,46] This study used perceived or subjective social isolation, which reflects how respondents feel about their circumstances and the quality of their relationships rather than objectively assessing attributes such as the number of contacts, frequency of participation or living arrangements.[5,6,8,12,22,47,48] The subjective measure captures intimate, relational and collective feelings of loneliness—the three underlying constructs in the Revised UCLA Loneliness Scale[31]—and incorporates sense of community belonging. Subjective social isolation does not depend on an arbitrary decision about what size of network or frequency of participation is sufficient. Satisfaction with networks and their size are sep-

Table 3
Unadjusted and adjusted odds ratios relating social isolation to selected characteristics, by sex, household population aged 45 or older, Canada excluding territories, 2008/2009

	Men									Women								
				Adjusted									Adjusted					
	Unadjusted			Model 1			Model 2			Unadjusted			Model 1			Model 2		
		95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval	
Characteristic	Odds ratio	from	to	Odds ratio	from	to	Odds ratio	from	to	Odds ratio	from	to	Odds ratio	from	to	Odds ratio	from	to
Household education																		
Postsecondary or higher	0.7*	0.6	0.9	0.9	0.7	1.0	0.9	0.7	1.1	1.0	0.8	1.2	1.1	0.9	1.3	1.2	1.0	1.4
Less than postsecondary†	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...
Living arrangements																		
Alone	3.3*	2.8	4.0	3.2*	2.6	3.9	3.1*	2.5	3.8	1.6*	1.4	1.8	1.8*	1.5	2.1	1.7*	1.5	2.0
With others†	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...
Regular driver																		
Yes	0.6*	0.4	0.7	0.8*	0.6	1.0	1.1	0.8	1.5	0.7*	0.6	0.8	0.6*	0.5	0.8	0.8*	0.7	1.0
No†	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...
Labour force participation																		
Yes	1.0	0.8	1.2	0.7*	0.5	0.9	0.8	0.6	1.1	0.9	0.8	1.1	0.7*	0.6	0.9	0.9	0.7	1.2
No†	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...
Functional limitations (continuous)																		
Hearing	1.02	0.98	1.05	1.03	1.00	1.07	1.00	0.97	1.04	1.06*	1.02	1.10	1.07*	1.03	1.11	1.04*	1.00	1.09
Vision	1.06*	1.01	1.12	...	...	...	1.05	1.00	1.12	1.07*	1.03	1.10	...	...	...	1.02	0.98	1.07
Speech	1.15	0.93	1.41	...	...	...	1.13	0.89	1.42	1.10	0.99	1.21	...	...	...	1.00	0.90	1.11
Mobility	1.06*	1.03	1.09	...	...	...	0.98	0.93	1.03	1.07*	1.05	1.08	...	...	...	1.03*	1.01	1.05
Dexterity	1.00	0.94	1.07	...	...	...	0.97	0.89	1.05	1.06*	1.01	1.11	...	...	...	0.95	0.88	1.04
Pain	1.04*	1.02	1.06	...	...	...	1.00	0.97	1.02	1.06*	1.05	1.07	...	...	...	1.03*	1.01	1.05
Emotion	1.35*	1.28	1.42	...	...	...	1.29*	1.21	1.38	1.37*	1.28	1.46	...	...	...	1.29*	1.20	1.38
Cognition	1.16*	1.12	1.20	...	...	...	1.11*	1.05	1.17	1.13*	1.10	1.17	...	...	...	1.06*	1.02	1.11
Incontinence																		
Yes	1.2	0.9	1.6	...	...	...	0.9	0.7	1.4	1.6*	1.3	1.9	...	...	...	1.1	0.9	1.4
No†	1.0	...	...	...	...	...	1.0	...	...	1.0	...	...	...	...	...	1.0	...	...
Fear of falling																		
Yes	1.3*	1.1	1.6	...	...	...	1.5*	1.1	2.0	1.3*	1.1	1.6				1.4*	1.1	1.7
No†	1.0	...	...	...	...	...	1.0	...	...	1.0	...	...	...	...	...	1.0	...	...

... not applicable
* significantly different from reference category ($p < 0.05$)
† reference category
Note: Odds ratios adjusted for age and age^2 to take into account the non-linear relationship between age and social isolation (Figure 1).
Source: 2008/2009 Canadian Community Health Survey–Healthy Aging.

arate concepts that are not necessarily correlated.[8] The subjective measure best reflects the key question—whether people who have difficulty communicating because of hearing problems feel isolated from those around them.

What is already known on this subject?

- Previous research has found associations between hearing status and social isolation, although not specific to the Canadian population.
- In 2012/2013, 19% of the adult population had hearing loss in the frequencies associated with normal speech, and 35% in the high-frequency range associated with age-related loss.
- At ages 70 to 79, 65% had speech-frequency loss, and almost everyone (94%) had high-frequency loss.
- The number of Canadians with hearing loss is expected to increase as the population ages.

What does this study add?

- According to an analysis of a large, population-based sample representative of Canadians 45 or older, 7% (8% of men and 5% of women) had hearing difficulties that limited their ability to understand normal conversations.
- An estimated 12% of men and 16% of women were socially isolated—they reported some feelings of loneliness and felt a weak or somewhat weak sense of community belonging.
- People aged 45 to 59 were more likely than those aged 60 or older to be socially isolated.
- Hearing difficulties were associated with social isolation among women, but not among men, even when accounting for sociodemographic characteristics, other functional limitations, incontinence, and fear of falling.

Numerous age-related transitions can disrupt social networks and engagement: retirement and the concomitant change in role and social contacts, becoming a caregiver, changing health status, lack of transportation including the loss of the ability or desire to drive, death of significant others, and a move to alternate living arrangements.[13,22,49] The baby boom generation may be at a greater risk of social isolation than earlier generations because they are more likely to live alone, to have never married, and to have fewer children.[50]

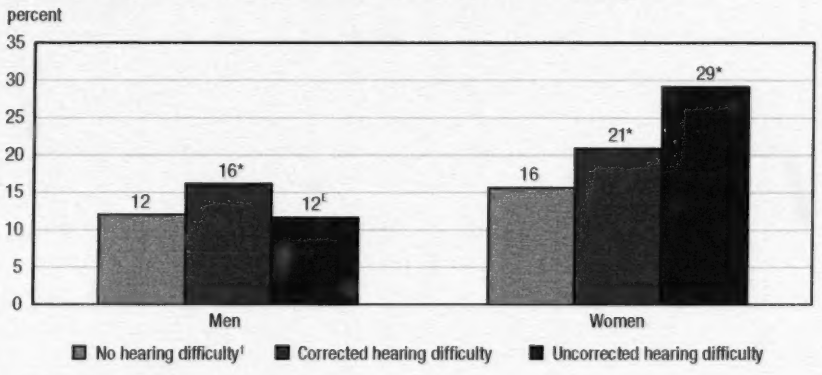
Results from this study indicate that social isolation was more common among 45- to 59-year-olds than among people aged 60 or older, which is consistent with the work of Cacioppo et al.[51] Older adults who retire may have more time for volunteering and other activities that foster social connections, whereas many in the younger cohort have responsibilities that create stress from the competing demands of work, childcare and eldercare and limit time and energy to connect with others.[52,53] This study found that high daily stress was associated with social isolation and that 45- to 59-year-olds were more likely than older people to report that their daily lives were quite or extremely stressful.

Working–age people who were not in the labour force were more likely to be isolated. Hawthorne[54] found that the unemployed, those with work injuries, students and homemakers were more likely to be isolated than the fully employed. It could be that employment-related activities protect people from isolation, or that middle-aged adults who are not in the labour force have health issues or family responsibilities that contribute to social isolation.

Interventions often aim to increase social interactions in group settings.[55,56] However, people with hearing limitations may avoid socially challenging situations and feel deprived by their reduced ability to participate.[45] Interventions designed for one-on-one interaction and those promoting the use of technology for non-verbal communication (for example, Internet) may be more effective for combating social isolation among those with hearing impairments.[55]

This study demonstrates the importance of evaluating men and women separately. Future research could focus on sex differences in the hearing loss/social isolation relationship. Research could further examine the role of assistive technology, including teletypewriter (TTY) services, improved telephone

Figure 2
Percentage reporting social isolation, by hearing status and sex, household population aged 45 or older, Canada excluding territories, 2008/2009



E use with caution
* significantly different from reference category ($p < 0.05$)
† reference category
Note: Because of small sample numbers, percentage who "cannot hear at all" not reported.
Source: 2008/2009 Canadian Community Health Survey–Healthy Aging.

features, and personal computing devices for non-verbal communication such as e-mail and text messaging.[5,16,25] Co-pathologies could be explored—multiple health and disability problems increase with age and could contribute to social isolation and interfere with the adoption of technologies that aid social connections.[57] Finally, other mitigating factors could be examined such as the impact of family and friends, and level of social support.

Limitations

The cross-sectional data are a limitation of this study. The temporal order of hearing loss and social isolation could not be established. People were classified according to their current hearing status, regardless of their hearing loss history. However, hearing impairment may be present at birth or occur over the life course; onset may be sudden or gradual. The timing and speed of hearing loss may affect individuals' ability to adapt and their feelings of social isolation.

Members of the Deaf community who communicate with Sign language cannot be identified in the CCHS-HA – there is no reason to expect that they would be at any greater risk of social isolation than the hearing-abled.

Information about cochlear implants or the quality and use of hearing aids was not available. Transitions associated with aging that may contribute to social isolation could not be captured—changing roles, loss of significant others, changing living arrangements that disrupt social networks, and developing health issues that limit connections.

The exclusion of proxy respondents, who comprised 2.2% of the CCHS-HA sample, could weaken estimates of the association between functional impairment and social isolation. People with proxy respondents were more likely to be men, to have hearing difficulties, and to be older and more functionally impaired than were non-proxy respondents (Appendix Table A).

The results indicate that social isolation diminishes somewhat with age. This could reflect a healthy survivor effect whereby those who are socially connected and more likely to remain healthy and/or have support, are represented in this study, whereas those who are more isolated may experience earlier mortality or a move to an institution. Residents of long-term care facilities, who may be more likely to have hearing loss and experience social isolation, were excluded from the CCHS-HA.

Conclusion

Hearing impairment was found to be associated with social isolation among Canadian women aged 45 or older, but not among men, a difference that could be further examined in future research. Social isolation could become more prevalent as the number of seniors in Canada grows and the percentage of the population experiencing hearing impairment increases. The low rate of hearing aid use among people with hearing difficulties suggests that future research could examine whether assistive technology has mitigated the isolation experienced by people with hearing limitations.

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Appendix

Table A
Canadian Community Health Survey–Healthy Aging sample and percentage distribution of selected characteristics, by proxy status, household population aged 45 or older, Canada excluding territories, 2008/2009

	Proxy respondents				Non-proxy respondents			
		Estimated				Estimated		
	Sample n	Number '000	%	SE	Sample n	Number '000	%	SE
Total	689	301	100.0		30,176	13,333	100.0	
Sex								
Men	360	196	65.2†	3.3	12,937	6,361	47.7	0.1
Women	329	105	34.8†	3.3	17,239	6,972	52.3	0.1
Mean age	689	301	64.7†	1.0	30,176	13,333	60.4	0.0
Household education								
Postsecondary or higher	436	205	69.6	4.3	17,537	8,907	68.5	0.6
Less than postsecondary	221	89E	30.4	4.3	12,071	4,102	31.5	0.6
Functional impairment								
Mean HUI3	633	282	0.6†	0.0	29,473	13,124	0.9	0.0
Hearing difficulty								
None	439	243	82.5†	2.4	26,267	12,347	93.5	0.2
Any hearing difficulty	223	51	17.5†	2.4	3,488	864	6.5	0.2
Mild	71	16E	5.6E†	1.2	1,656	431	3.3	0.1
Moderate or severe	152	35	11.9†	1.8	1,832	433	3.3	0.1

E use with caution
† significantly different from non-proxy respondents ($p < 0.05$)
SE = standard error
Note: Because of missing data, detail may not sum to total.
Source: 2008/2009 Canadian Community Health Survey–Healthy Aging.